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## Three-charge-particle systems in the framework of coupled coordinate-space few-body equations

We study three-charge-particle low-energy elastic collision and particle-exchange reaction with special attention to the systems with Coulomb and an additional nuclear interaction employing a close-coupling expansion scheme to a set of coupled two-component few-body equations [1,2]. First we apply our formulation to compute low-energy elastic scattering phase shifts for the  $d+(t\mu^-)_{1s}$  collision, which is of significant interest for the muon-catalyzed-fusion D-T cycle. Next, we study the particle-exchange reaction  $d+(pX^-)\rightarrow p+(dX^-)$  with the long-lived elementary heavy lepton stau  $X^-$ , which can play a critical role in the understanding of the Big-Bang nucleosynthesis and the nature of dark matter. We also study the total cross sections and rates for two particle-exchange reactions involving deuteron (d), triton (t), and antiprotons ( $p^-$ ) e.g.,  $p^- + (d\mu^-)_{1s} \rightarrow (pd)_{1s} + \mu^-$  and  $p^- + (t\mu^-)_{1s} \rightarrow (p^-t)_{1s} + \mu^-$ , where  $\mu^-$  is a muon. The effect of the final state short-range strong ( $p^-d$ ) and ( $p^-t$ ) nuclear interactions is significant in these reactions, which increases the reaction rates by a factor of  $\sim 3$ .

1. R. A. Sultanov and S. K. Adhikari, EPJ Web of Conferences 262, 01023 (2022).
2. R. A. Sultanov, D. Guster, and S. K. Adhikari, Atoms 6(2), 18 (2018) ([doi.org/10.3390/atoms6020018](https://doi.org/10.3390/atoms6020018)).

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